**Participant Name:**

Sieglinde Snapp

**Abstract Title:**

Below- and aboveground pigeonpea productivity in a novel doubled-up legume cropping system across three agro-ecologies in central Malawi.

**Authors:**

Chiwimbo Gwenambira1, Regis Chikowo1, Bekunda Mateete2, Sieglinde Snapp1

1Plant, Soil and Microbial Sciences Department, Michigan State University, East Lansing, MI 48824, USA

2International Institute of Tropical Agriculture (IITA), Africa RISING, Arusha, Tanzania

**Abstract Text:**

Use of legume species that biologically fix nitrogen, provide high protein grain, and recycle nutrients through deep capture is one approach that has shown promise for sustainable intensification of cropping systems in Malawi. However, empirical data on root and shoot biomass additions through shrubby legumes has largely remained scarce. Field experiments were set-up across three agro-ecologies in central Malawi, during the 2013/14 cropping season. Pigeonpea was planted as a sole crop or in an additive intercrop system with soyabean, groundnut or cowpea, a novel system that is referred to as the doubled-up legume technology. The system is hinged on the initial slow growth of pigeonpea, facilitating growth of companion crops as if sole cropped. Additionally, a maize-pigeonpea intercrop was included. Six months after planting, representative pigeonpea plants across treatments were cut at ground level, and above ground components separated into stems, twigs and leaves. Roots of the same plants were excavated for the 0-0.2, 0.2-0.4 and 0.4-0.6 m layers within the effective zone of the pigeonpea planting station, with a surface area of 0.75 m x 0.9 m, for 0.135 m3 soil volume per layer. Across sites, pigeonpea above ground biomass was largest for sole pigeonpea with 12.24 Mg ha-1, compared with 2.39 Mg ha-1 for the pigeonpea/maize intercrop. The pigeonpea/groundnut and pigeonpea/soyabean intercrops had 10.10 and 6.05 Mg ha-1 pigeonpea aboveground biomass, respectively. Root biomass was largely confined to the 0-0.2 m layer, with trends similar to that for aboveground biomass. Root biomass ranged 0.65-1.62 Mg ha-1 for the 0-0.2 m layer, 0.013- 0.12 Mg ha-1 for the 0.2-0.4 m layer, and a maximum of only 0.023 Mg ha-1, for the 0.4-0.6 m layer. At below 0.2 m depth, fine pigeonpea roots were dominant, being an essential attribute for nutrient and water uptake rather than soil organic matter replenishment. We conclude that intra-specific competition in a well fertilized pigeonpea/maize intercropping system is rather large, while pigeonpea productivity in a pigeonpea/groundnut system is comparable to sole cropped pigeonpea, with additional grain benefits. The Africa RISING program is promoting later system for enhanced land productivity on smallholder farms.

**Keywords:**

Biological N2-fixation, pigeonpea, soil organic matter, sustainable intensification, root biomass,